JOINT COUNTERMOBILITY CAPABILITIES
IN THE DEPARTMENT OF DEFENSE

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The opinions and conclusions expressed herein are those of the student author and do not necessarily represent the views of the U.S. Army Command and General Staff College or any other governmental agency. (References to this study should include the foregoing statement.)

ABSTRACT

JOINT COUNTERMOBILITY CAPABILITIES IN THE DEPARTMENT OF DEFENSE, by MAJ Nathan J. Smith, 86 pages.

Today's military leadership is faced with the changing culture of a financially constrained environment. The Department of Defense has noted a shortcoming in countermobility capability and emphasized a shift from COIN to small scale wars in a variety of environments and has also emphasized the use of interorganizational capabilities. This thesis examines if US land forces (US Army and US Marines) are properly trained, equipped, and manned to support countermobility operations. Both the US Army and the US Marines have fundamentally similar doctrine and training for countermobility operations. Historical studies of conflicts in the Philippines, Korea, and Vietnam are used to show how countermobility operations can be applied to today's capabilities. Reductions in manning will have potential impacts to countermobility. Although challenged, both the US Army and the US Marine Corps are able to conduct countermobility operations without conventional mines on a variety of battlefields.

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TABLE OF CONTENTS

ACRONYMS

ABCT	Armor brigade combat team
ADAM	Area Denial Artillery Muntion
AIT	Advanced Individual Training
ALC	Advanced Leaders Course
AP	Antipersonnel
AT	Antitank
CEB	Combat Engineer Battalion
CENCO	Combat Engineer Noncommissioned Officer Course
CEO	Combat Engineer Officer Course
CEPS	Combat Engineer Platoon Sergeant Course
CMH	Center for Military History
DoD	Department of Defense
DPICM	Dual Purpose Improved Conventional Munitions
EBOLC	Engineer Basic Officers Leader Course
ECCC	Engineer Captain Career Course
ERDC	Engineer Research and Development Center
ESB	Engineer Support Battalion
EWS	Expeditionary Warfare School
FASCAM	Family of scatterable mines
GCE	Ground Combat Element
GEMSS	Ground Emplaced Mine Scattering System
ILE	Intermediate Level Education
JEOC	Joint Engineer Operations Course

MAGTF	Marine Air Ground Task Force
MCU	Munition control unit
MEU	Marine expeditionary unit
MOPMS	Modular Pack Mine System
MOS	Military occupation specialty
MW	Mine Warfare
MWSS	Marine Wing Support Squadron
NCOES	Noncommissioned Officer Education System
OES	Officer Education System
OJT	On the job training
PM CCS	Project Manager Close Combat Systems
PMCS	Preventive Maintenance Checks and Services
RAAM	Remove Anti-Armor Munition
SAW	School of Advance Warfare
SLAM	Selectable Lightweight Attack Munition
SLC	Senior Leader Course
TTP	Tactics, Techniques, and Procedures
TBS	The Basic School
USAES	US Army Engineer School
USMES	US Marine Engineer School
WAM	Wide Area Munition
WLC	Warrior Leader Course

TABLES

CHAPTER 1

INTRODUCTION

Background

Today's military leadership is faced with the changing culture of a financially constrained environment. With the focus of the last decade on counterinsurgency (COIN), only basic[1] capabilities of mobility, countermobility, and survivability within combat engineering have been fully utilized. Joint Publication (JP) 3-24, *Counterinsurgency Operations*, emphasizes that COIN defense is primarily aimed at insurgents and counter-guerrillas.[2] The Department of Defense (DoD) has noted a shortcoming in capability and emphasized a shift from COIN to small scale wars in a variety of environments. This change in how the military will likely operate is demonstrated in the 2013 Army Strategic Planning Guidance. General Raymond T. Odierno, U.S. Army Chief of Staff, and Mr. John McHugh, Secretary of the Army, highlight how attention is now geared toward the regional alignment of forces for combatant commanders and 11 mission sets.[3] The Department of Defense has also emphasized the use of interorganizational capabilities, such as partnering with other agencies and countries to develop a stronger defense.

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[1]The term "basic" is used to describe the difference in countermobility. Roughly two decades ago the military was focused on large scale tactics referred to as high intensity conflict (HIC) prior to 2011.

[2]US Department of Defense, JP 3-24, *Counterinsurgency Operations* (Washington, DC: Government Printing Office, October 2009), xi.

[3]US Department of Defense, *2013 Army Strategic Planning Guidance* (Washington, DC: Government Printing Office, 2013), 1.

The Department of Defense's focus will continually adjust to new and emerging threats. The drawdown of US forces from Afghanistan at the end of 2014 and the reduction of US forces total strength by 2017 will result in the military focus adapting to this recent operational environment of new and emerging threats. As of August 2013, the Department of Defense's 11 prioritized mission sets are: (1) counter terrorism and irregular warfare, (2) deter and defeat aggression, (3) counter weapons of mass destruction, (4) defend the homeland and provide support to civil authorities, (5) project power despite anti-access/area denial challenges, (6) operate effectively in cyberspace, (7) operate effectively in space, (8) maintain a safe, secure, and effective nuclear deterrent, (9) provide a stabilizing presence, (10) conduct stability and counterinsurgency operations, and (11) conduct humanitarian assistance, disaster relief, and other operations.[4]

Countermobility, to some degree, could be applied toward prioritized mission sets 1, 2, 5, and 10 in support of the combatant commander. Considering the numerous missions that the Department of Defense is responsible for, four out of eleven mission sets, or 37 percent, is a rather high percentage for the execution of engineer countermobility. In other words, the possibility of needing countermobility is greater than a one in three chance. Although the general theme of the mission sets is not geared to large scale wars, countermobility still plays a part in the prioritized mission sets.

Mr. Leon E. Panetta, former U.S Secretary of Defense, stated "In this resource-constrained era, we will also work with NATO[5] allies to develop a 'Smart Defense'

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[4]US Department of Defense, *2013 Army Strategic Planning Guidance,* 1.

[5]North Atlantic Treaty Organization's membership consists of 28 countries.

approach to pool, share, and specialize capabilities as needed to meet 21st century challenges."[6] The change of focus from large scale defenses or the use of countermobility to an after-thought might potentially impact the Department of Defense's search for a solution to the capability gap present with the limited use of landmines. Compounding the issue is the fact that not every military branch conducts countermobility.

Upon review of Joint Publication 3-34, *Joint Engineer Operations*, two of the four services are designated to conduct combat engineering: the US Army and the US Marine Corps. Combat engineering is defined in Joint doctrine as consisting "of those engineer capabilities and activities that support the maneuver of land combat forces and requires close support to those forces."[7] Although both mobility and countermobility fall within this definition, this paper will focus on the countermobility aspect of maneuver. Current Army Doctrine Reference Publication (ADRP) 1-02, *Terms and Military Symbols*, defines countermobility operations as "Those combined arms activities that use or enhance the effects of natural and man-made obstacles to deny an adversary freedom of movement and maneuver."[8] Joint Publication 3-15, *Barriers, Obstacles, and Mine Warfare*, states that countermobility operations include the "employment of barriers, obstacles, and scatterable mines/networked munitions" and their objective is to "disrupt,

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[6]US Department of Defense, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: Government Printing Office, January 2012), 9.

[7]US Department of Defense, JP 3-34, *Joint Engineer Operations* (Washington, DC: Government Printing Office, June 2011), 12.

[8]US Department of Defense, ADRP 1-02, *Terms and Military Symbols* (Washington, DC: Government Printing Office, September 2013), 1-15.

fix, turn, or block enemy forces and protect friendly forces."[9] Each of the four effects has a different purpose in shaping the battlefield.

The purpose of a disrupt obstacle is to fragment an enemy's formation and pace, whereas a fix obstacle reduces an enemy's speed in a designated area for massing fires. The purpose of a turn obstacle is to direct an enemy's movement to one beneficial for the defender, while a block obstacle is to prevent an enemy from moving forward or through a specific area.[10] Doctrine does not specify that only mines or munitions have the task to disrupt, fix, turn, or block the enemy. Although obstacle emplacement is usually considered easier with mines or munitions, engineers can potentially employ barriers and various obstacles to achieve the same effect.

Other terms used to define obstacles are situational obstacles and protective obstacles. A situational obstacle is "an obstacle that a unit plans and possibly prepares prior to starting an operation, but does not execute unless specific criteria are met."[11] A protective obstacle is used to protect personnel and assets from hostile actions by impeding the movement and maneuver of enemy forces or criminal elements."[12] Simply, a situational obstacle is an obstacle with a lower priority for countermobility effort and is often tied to a decision point such as closing a lane or avenue of approach. A protective

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[9]US Department of Defense, JP 3-15, *Barriers, Obstacles, and Mine Warfare* (Washington, DC: Government Printing Office, June 2011), 15-16.

[10]US Department of Defense, FM 20-32, *Mine/Countermine Operations* (Washington, DC: Government Printing Office, May 1998), 2-6.

[11]US Department of Defense, ATP 3-90.8, *Combined Arms Countermobility Operations* (Washington, DC: Government Printing Office, June 2012), 1-6.

[12]Ibid., 1-7.

obstacle is emplaced without a decision point and used to augment survivability for the close fight.

In order to understand what countermobility capabilities the DoD has, one must first understand why the DoD is not using all of its capabilities. A reason the US no longer uses conventional mines is the Ottawa Treaty. Proponents of the Ottawa Treaty, or mine-ban treaty, of 1997 were successful in their efforts to get several state actors to agree to no longer use anti-personnel landmines.[13] However, as of March 2013, only 133 countries signed the treaty and 161 countries ratified the treaty.[14] This treaty will affect the United States Asia-Pacific focus as roughly half of the countries in Asia-Pacific have signed the treaty.[15] South Korea and Vietnam have neither signed nor ratified the treaty, whereas the Philippines has both signed and ratified the treaty.[16]

Although the United States has neither signed nor ratified the treaty (the only NATO country to not officially endorse the treaty), as of January 2011, Joint doctrine states "US forces are no longer authorized to utilize persistent land mines anywhere."[17] If the United States signed the treaty, it would be required to destroy its roughly 10

[13] United Nations, "Convention on the Prohibition of the Use, Stockpiling, Production and Transfer of Anti-Personnel Mines and on their Destruction," 18 September 1997.

[14] Arms Control Association, "The Ottawa Convention: Signatories and States-Parties," http://www.armscontrol.org/factsheets/ottawasigs (accessed 30 April 2014).

[15] Ibid.

[16] Ibid.

[17] US Department of Defense, JP 3-15, 5.

million anti-personnel land mines.[18] Using the rough cost of $3 per landmine, that would be $30 million worth of equipment that the United States would have to destroy.[19] The United States still takes exception to the policy in its use for "mine action/demining training and research purposes" and its "bilateral agreement that directs persistent anti-personnel landmines and anti-vehicular landmines stockpiled in the Republic of Korea (ROK) for use by ROK forces for the defense of the Korean Peninsula….but only until the end of 2018."[20] The Korean demilitarized zone (DMZ) is heavily fortified by mines and the destruction of the mines could have a negative impact on the safety South Korea and the US personnel living in the country. The antipersonnel landmines in US inventory that are no longer used include the M14 and M16 antipersonnel mines. The anti-vehicular landmines in the US inventory that are no longer used include the M15, M19, and M21 anti-tank mines.

Purpose

The purpose of this research is to determine if US land forces are properly trained, equipped, and manned to support countermobility operations without conventional mines on a variety of Asia-Pacific battlefields. This study will look at countermobility in an Armor Brigade Combat Team (ABCT) and Marine Expeditionary Unit (MEU), using

[18]Arms Control Association, "Mine Policy Review Near End, US Says," http://www.armscontrol.org/act/2013_01-02/Mine-Policy-Review-Near-End-US-Says (accessed 30 April 2014).

[19]United Nations, "Unit 1: The Scourge of Landmines," http://www.un.org/cyberschoolbus/banmines/units/unit1c.asp (accessed 30 April 2014).

[20]US Department of Defense, JP 3-15, 30.

several aspects of the doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) concept from a Joint perspective.

Secondary research questions regarding training, equipping, and manning are as follows: Are there historical examples from the Asia-Pacific region of successful countermobility operations without conventional land mines? What is the capability difference between FASCAM and conventional mines? Is new technology being developed to fill or supplement the capability gap of conventional mines? What is currently being trained in the Advanced Leader Course (ALC) and the Senior Leader Course (SLC)? What effect will the restructuring have on Army military occupation specialty (MOS) 12 and Marine Corp MOS 1300 overall?

Assumptions

This study assumes that the United States will continue to follow the Ottawa treaty despite its non-signatory status. The United States has doctrine that supports the intent, but signing it will affect research, training, and operations in South Korea. The study assumes that the United States will not change the policy for the duration or command approval of FASCAM. This assumption serves as the basis for determining the usefulness of FASCAM as an obstacle and FASCAM's ability to be used in certain situations. The study assumes that the US Army will maintain proponency for countermobility. If the proponency changes, the way the military trains and applies countermobility will need to be re-evaluated. Additionally, the assumption is made that no significant changes will be made to the concept "Doctrine 2015" with the changing of

the Chief of Engineer Doctrine.[21] The study assumes that US Army Engineer Research and Development Center (ERDC) does not have any new developments that are ready to be fielded.[22] New equipment that is fielded could drastically change the capabilities within the military for countermobility. The study assumes that Soldiers at Basic Training and Warrior Leader Course (WLC) will not be taught about FASCAM. Basic Training is a course that appeals to general Soldiering. WLC is a course that focuses on refining Soldier skills and developing basic leader skills. The study assumes that Marines at The Basic School (TBS) will not be taught about FASCAM. TBS is an introductory course that teaches general engineering. Thus, the study assumes that Soldiers and Marines will be taught FASCAM in depth at their first unit. The study also assumes the US Army and US Marine doctrine that is in draft form will not significantly change prior to it being published. Any changes to doctrine could impact how countermobility is used within the ABCT and MEU.

Definitions

The following terminology and definitions are important to this study for various reasons. A more thorough glossary with additional terms not defined below is provided at the end of the paper. US Army Engineer Research and Development Center (ERDC) mission is to "helps solve our Nation's most challenging problems in civil and military engineering, geospatial sciences, water resources, and environmental sciences for the

[21]Army Chief of Engineering Doctrine is expected to change at the end of May 2014.

[22]The XM1100 Scorpion mine system is included in this study.

Army, Department of Defense, civilian agencies, and our Nation's public good."[23] ERDC Geotechnical and Structures Laboratory (GSL) is the center of expertise in ground vehicle mobility and countermobility for the Department of Defense.[24]

Combat engineering is defined as "engineering capabilities and activities that closely support the maneuver of land combat forces consisting of three types: mobility, countermobility, and survivability."[25] The definitions of countermobility and countermobility operations are very similar. Marines still use the term countermobility while Army uses countermobility operations. Countermobility is "the physical shaping of the battlespace to alter the scheme of maneuver of the enemy"[26] and countermobility operations is "the construction of obstacles and emplacement of minefields to delay, disrupt, and destroy the enemy by reinforcement of terrain."[27] Throughout this paper, countermobility and countermobility operations will be used interchangeably.

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[23]US Army Corps of Engineers, "Engineer Research and Development Center," http://www.erdc.usace.Army.mil/About/MissionandVision.aspx (accessed 30 April 2014).

[24]US Army Corps of Engineers, "Ground Vehicle Mobility and Countermobility," http://www.erdc.usace.Army.mil/Media/FactSheets/FactSheetArticleView/tabid/9254/Article/476686/ground-vehicle-mobility-and-countermobility.aspx (accessed 30 April 2014).

[25]US Department of Defense, JP 1-02, *Department of Defense Dictionary of Military and Associated Terms* (Washington, DC: Government Printing Office, February 2014), 43.

[26]US Department of Defense, MCWP 3-17, *Engineer Operations* (Washington, DC: Government Printing Office, February 2000), 4-11.

[27]US Department of Defense, JP 1-02, 60.

An obstacle is “an object that you have to go around or over: something that blocks your path.”[28] An obstacle is the basic building block of countermobility. The term will be used throughout the paper to describe effects. Without a proper understanding of an obstacle, some concepts might not be grasped.

Most obstacles can be classified by two major categories: manmade and natural. Manmade obstacles can be divided into explosive and non-explosive categories. Landmines are a subcategory of manmade explosive obstacles. Two types of manmade obstacles that require further definition are non-explosive constructed obstacles and other non-explosive obstacles. Non-explosive constructed obstacles include wire obstacles, tank ditches, and berms. Other non-explosive obstacles include vehicle hulks and punji sticks.[29] Natural obstacles can be divided into four categories: vegetation, water features, soil compaction, and surface configuration. The vegetation category includes tress, vines, grasses, and brush. The water features category includes rivers, lakes, and streams. The soil compaction category includes sand and mud. The surface configuration category includes slope, elevation, and rock formations.[30]

Another area which needs to be understood is determining the location of obstacles. One consideration for the placement of obstacles is denial development. JP 3-

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[28]Encyclopaedia Britannica, “Obstacle,” http://www.merriam-webster.com/ (accessed 30 April 2014).

[29]Ibid., 1-4 to 1-5.

[30]US Department of Defense, ATP 3-90.8, 1-2.

15, *Barriers, Obstacles, and Mines* defines denial considerations as "A denial measure is an action to hinder or deny the enemy the use of territory, personnel, or facilities."[31]

US Army Force Management System (FMSWeb) is a web based system used to document Army force structure to include manpower and equipment.[32] FMSWeb is a very useful system and it plays an important part in validating information found from other sources.

Scope

This study focuses on US Army and US Marine Corps capabilities due to their involvement in land countermobility. The study does not address coalition or multinational aspects unless needed to illustrate historical examples of countermobility. The study does not address current landmine use in Korea as it was already highlighted. The study does also not address current landmines in Cuba as it is beyond the Pacific region. The time period discussed during the historical references is from 1939 to present, specifically countermobility during World War II, the Vietnam War, and the Korean War. These historical references are used due to the Department of Defense focus on the Asia-Pacific. Although countermobility applied properly in decisive action is used in offense, defense, and stability, it will only be discussed in terms of defense for this thesis.

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[31]US Department of Defense, JP 3-15, 12-13.

[32]US Army, "USAFMSA," https://fmsweb.Army.mil/unprotected/splash/Mission_statements.aspx (accessed 30 April 2014).

Limitations

FMSWeb generally publishes equipment and manning data for up to two years plus or minus the current fiscal year. FMSWeb also only has US Army data and not US Marine data. FMSWeb is used to compare data found online due to the systems classification of for official use only (FOUO).

Delimitations

The study focuses only on active duty personnel. The study's focus is analyzing two different services. The multiple specialties and nuances within both the reserves and national guard would exponentially expand the analysis required. The study reviews three of the four major types of military publications: Joint, multiservice, and service. The fourth kind of major publication, multinational, will not be reviewed. Additionally, although booby traps are used as obstacles during countermobility operations and there is both US Army and US Marine doctrine which covers booby traps, booby traps are not analyzed in this paper.

The study orients on the Asia-Pacific due to the current US military focus as illustrated in the 2013 Strategic Planning Guidance. The study analyzes aspects[33] of the non-commissioned officer education system (NCOES) and officer education system (OES) at the Company grade level. The US military tends to teach concepts based on rank. As Soldiers progress, their level of understanding is expected to increase and their duration at school will be longer. Staff Sergeants, Sergeants First Class, Lieutenants, and

[33]Course overviews, syllabuses, or discussions with cadre.

Captains will most likely be the selection chosen for in depth training on how to employ and incorporate FASCAM during countermobility operations.

Significance of study

The military is currently undergoing restructuring in both budget and resources. As the military drawdown occurs, it is important that the execution of countermobility remains feasible and relevant. The United States Army Engineer School (USAES) has taken steps to keep the capability of countermobility within the Brigade through the creation of the Brigade Engineer Battalion (BEB). The USAES is still paying particular interest to countermobility for various reasons, such as ensuring the BEB concept works and that engineers have the proper doctrine and training needed. Additionally, the background has already shown how countermobility plays a part in the Department of Defense mission sets. This study on countermobility is intended to generate discussion among leaders and within the different services.

The next chapter highlights some of the key works reviewed during the research of this paper and how they relate to this study. The chapter starts with research that discusses mines in general, followed by historical research, then research that addresses topics of the primary and secondary questions, followed by future and alternate countermobility capabilities.

CHAPTER 2

LITERATURE REVIEW

Books, magazines, theses, government documents and publications, and references posted to the World Wide Web were reviewed for this study and are highlighted below. They are organized into the following categories: background, historical research, primary and secondary questions, future and alternate countermobility capabilities, and miscellaneous.

Background

The result of my research shows significant data available on the Ottawa Treaty (ban on anti-personnel mines). The Ottawa treaty is important to this research because it limits the use of conventional mines. By understanding what these limitations are for the United States and key countries in the Asia-Pacific, there is a greater appreciation of what capabilities the United States has lost. The Ottawa Treaty serves as a baseline to determine if US forces are properly manned, trained, and equipped to conduct countermobility on a variety of Asia-Pacific battlefields.

The article “Alternative Anti-personnel Mines” discusses the evolution of the Ottawa treaty and the treaty’s effect on conventional landmines. The article also discusses alternative methods and mines that are in development. The armscontrol.org website outlines the purpose of the treaty and provides a current update. The website also discusses the status of the treaty and what member states are still involved with adhering to the treaty.

Documented countermobility operations are rare and often not detailed. Data available on how to execute countermobility with existing capabilities are also sparse. Although there is limited data on countermobility from a Joint perspective, most Army and Marine doctrine are multiservice; they use the same doctrinal manuals.[34] Most research exists on countermobility with antipersonnel mines and the future without antipersonnel mines; little has been done on countermobility without anti-tank or anti-vehicular mines.

Historical Research

The paper "Historical Uses of Antipersonnel Landmines: Impact on Land Force Operations" discusses effects on the battlefield without antipersonnel landmines. The paper uses historical references from World War II (WWII), Korea, and Vietnam. One area that the paper highlights needing future research is "Do scatterable mines offer the flexibility needed to restrict the mobility and reduce the operational tempo of detected enemy formations?"[35] Although the paper was published in 1999, the topic remains relevant today.

Review of several Center for Military History (CMH) publications on battles in the Philippines has produced minimal information on the exact composition of allied obstacles and countermobility effects used. A lot of data exists on the defenses that the

[34]The US Army is the proponent for countermobility operations. However, Marine Corp Warfighting Publication (MCWP) 3-17, *Engineer Operations* is a good publication and will be cited.

[35]Roger L. Roy, and Shaye K. Friesen, *Historical Uses of Antipersonnel Landmines: Impact on Land Force Operations* (Kingston, Ontario, Canada: Department of National Defence Canada, October 1999), 48.

Japanese used; some information is on the same locations that the Philippine and US forces used in their defenses. One such reference is the paper "Japanese Defense of Cities as exemplified by Battle for Manila", which was written about the defense of the Philippines during World War II. Part one of the paper discusses how the Japanese created defensive positions and how they tied weapons systems into their defense. Another reference that provided data on Japanese defensive positions is CMH Publication 13-2, *Reports of General MacArthur*.

There are several areas of potential study during the Korean War. Research was conducted of various Center for Military History publications, *This Kind of War*, Army Engineer Association magazines, and several sites on the World Wide Web. The Battle of Osan (Operation Task Force Smith) is fairly documented and is presented as another battle where countermobility operations were lacking and the effects seen from lack of mines and engineer support were disastrous. Most documents seem to focus on the failure and not the steps taken by the unit's leadership, either officer or non-commissioned officer, to create a defensive position.

Information on countermobility during the Vietnam War is not as prevalent as survivability, mobility, and general engineering. CMH Publication 91-14, *Engineers at War* briefly touches on some aspects of countermobility. The publication generally discusses how both the Viet Cong and the US forces used different obstacles for their defense. CMH Publication, *The 1968 TET Offensive Battles of Quang Tri City and Hue,* goes into more detail on the strong point obstacle system or the McNamara line.

Primary and Secondary Questions

There are a lot of field and technical manuals covering the employment of conventional mines and FASCAM. The manuals briefly cover the time frames needed to emplace an obstacle effect and training required. USAES has created several documents that show the number of people in a unit, the time, and how or what training is needed per unit to emplace an obstacle effect. FMSWeb provides data on personnel and equipment in an Army unit plus or minus two years. The curriculum at various military schools illustrates the presence or lack of countermobility training and education. Marine Corps Warfighting Publication 3-17, *Engineering Operations,* along with several other Marine publications and the World Wide Web, cover the Marines employment of FASCAM. The Marine Corps Military Occupation Specialty (MOS) handbook, although slightly dated, serves as a starting point for understanding personnel responsibilities, training requirements, and unit structure. The Marine Corps Engineer School (USMES or Courthouse Bay) has basic information on the World Wide Web concerning their countermobility training and education.

Future and Alternate Countermobility Capabilities

Data are available on new and alternative methods for countermobility execution without the use of landmines. Various sources such as the North Atlantic Treaty Organization (NATO), land mine action webpage, and countries supporting the Ottawa treaty have conducted studies in an attempt to inform the world about new and alternative methods. The Defense News discussed how the XM1100 Scorpion mine system is a new program of record that is currently being tested. Additional research should reveal if there are any other systems becoming programs of records, if there is a proponent for training

other then ERDC, and if these new capabilities will be equipped and manned in engineer units.

Miscellaneous

Two Masters of Military Art and Science (MMAS) theses focused on countermobility with an emphasis on antipersonnel landmines. The MMAS thesis "A Mineless Battlespace" discusses the US Army's future battlespace without the use of conventional antipersonnel landmines. The paper also highlights the evolution of landmines and their use in the past. The MMAS thesis "Goalie without a mask" considers the ban on antipersonnel mines (Ottawa treaty) and its effects on US Army countermobility. This paper also highlights what tasks landmines achieve in regards to countermobility doctrine.

The next chapter clarifies the method and methodology used to illustrate joint countermobility. The analysis shows the effect or lack of effect of the removed conventional mines capability from the Department of Defense inventory.

CHAPTER 3

METHODOLOGY

This chapter defines the techniques used to determine if US land forces are properly trained, equipped, and manned to support countermobility operations without conventional mines on a variety of Asia-Pacific battlefields. The specific metrics and methods used for training, equipping, and manning are defined in the following sections.

Training

The study reviews publications such as training manuals, field manuals, and information from the World Wide Web with respect to countermobility. An analysis of the curriculum at various military schools is used to determine the presence or lack of a countermobility focus in company grade OES and NCOES. Discussions with USAES and the United States Marine Engineer School (USMES) were conducted for comparisons and confirmation, followed by an analysis of countermobility training.

A properly trained leader has received instruction on all FASCAM systems through a combination of the following methods and locations: formal schooling, additional training, on the job training (OJT), and independent study. Formal schooling is defined as specified training that the USAES or the USMES requires to continue being promoted. Additional training is defined as training that is not required for promotion and includes a mobile training team or specialty engineer course. OJT includes field training, sergeants training time, and leader professional development sessions. Independent study is defined as informal learning done by an individual to improve their understanding.

The most common ground-delivered FASCAM systems currently utilized for countermobility by engineer land forces are the MOPMS, Volcano, and Spider. Therefore, these three systems are the focus of determining if land forces are properly trained. Artillery and air delivery system training, although beneficial, is considered enhancing and not a requirement to be properly trained. A properly trained unit must have a qualified train-the-trainer in order to ensure that all FASCAM system training is conducted to standard. FASCAM training must include six areas of focus in order to be effective: employment theory or concepts, system components, how to PMCS the system, initiation procedures, retrieval procedures, and troubleshooting procedures.

The goal of the training research methodology is to identify what method the USAES and the USMES are using to train countermobility and determine if there are sustaining training systems present. The current assumption is the MOPMS and the Volcano are trained in depth at the unit. This assumption cannot be verified, except by contacting units directly. This type of specific unit research was not used for analysis. Reasons for non-inclusion include if there are either poorly planned or poorly resourced training schedules at particular units, then officers, NCOs, and Soldiers may not be receiving necessary training on FASCAM systems. USAES and Courthouse Bay were contacted to determine if and to what extent baseline FASCAM training is being conducted. The Spider system is currently being fielded by the US Army and new equipment training is being conducted by personnel from Picatinny Arsenal. Picatinny Arsenal and the USAES were asked if there is a train-the-trainer class. Additional questions that were researched were if they will be conducting new equipment training (NET) for every unit being fielded, is the NET given only once to a unit or if there will be

additional classes conducted in the future, is Picatinny Arsenal the only organization conducting the training, and if not, who else is conducting the training?

Equipping

Historical references, reports, and archival documents are used to show the effective use of countermobility with landmines, the ineffective use of countermobility without landmines, or the effective use of other obstacles combined with weapon systems for countermobility. This study shows how natural obstacles and manmade obstacles are used, to include their emplacement, and the obstacles' effect. The Department of Defense has numerous capabilities at its disposal. Further elaboration is done on the following categories in this paper: non-explosive constructed obstacles, other non-explosive obstacles, and landmines. The study compares the non-explosive constructed obstacles and other non-explosive obstacles to obstacles created using landmines.

The order of analysis is a discussion of the Philippines during World War II, the Korean War, and finally the Vietnam War. It is very likely that FASCAM was not used during these time periods due to either its recent creation or lack of fielding. However, conventional mines were used during World War II, the Vietnam War, and the Korean War. Historical information of a unit's composition and capabilities, specifically conventional mines, are used to show how the units set up their defense in the above battles. A comparison of today's composition and capabilities, specifically FASCAM, illustrates if today's units can achieve countermobility effects in the same situation.

The paper discusses current countermobility capabilities available to the US Army and US Marine Corps. The depiction of countermobility capability is achieved by examining the current land mine options and employment, and then discussing other

options currently available. There are several scatterable landmine systems with self-destruct (SD) capability that have been used by the Department of Defense commonly identified as the Family of Scatterable Mines (FASCAM). The most common examples of the FASCAM are the BLU 97/B Gator, M56 aircraft mine dispensing subsystem, M74 GEMSS (ground emplaced mine scattering system), M67 and M72 ADAM (area denial artillery munition), M70 and M73 RAAM (remote anti-armor munition), M77 and M131 MOPMS (modular pack mine system), Air and Ground VOLCANO, M93 Wide Area Munition (WAM) Hornet, and the XM-7 SPIDER.[36] Areas addressed include which FASCAM systems are still in the DOD inventory, the area that each system can affect, the time it takes to employ, and the approval authority. Approval authority is noted for each system and the length of time associated with that approval authority. Comparisons are made to the following conventional mines: M15, M19, and M21 anti-tank mines. Finally, the equipment in development and future countermobility capabilities are discussed.

The goal of the equipping research methodology is to determine from historical examples what type of countermobility was used in a particular battle, what obstacle effects were used, and what equipment was used to create the effects. The study looks at the Battle in Manila and the Battle in Bataan on the island of Luzon in the Philippines, the Tet Mau Than or the TET Offensive in Vietnam, and the Battle of Osan or Task Force Smith. A comparison is drawn to the capabilities within an ABCT or MEU to determine if today's unit has the equipment on hand to emplace a similar defense. Since the Special

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[36]US Department of Defense, FM 20-32, *Mine/Countermine Operations* (Washington, DC: Government Printing Office, May 1998).

Troops Battalion (STB)[37] will be turned into the Brigade Engineer Battalion (BEB) within the next year, the capabilities of the BEB is used, not the STB.

Manning

The study compares FMSWeb from the last two years through the next two years (2012-2016), the Quadrennial Defense Review (QDR), US Army doctrine, and US Marine Corps doctrine to determine if MOS manning changed or is projected to change. Based on results, analysis is conducted to determine if there are sufficient personnel to conduct countermobility operations for FASCAM and other obstacles.

A properly manned ABCT is a fully manned BEB according to the Modified Table of Organization and Equipment (MTOE). The BEB needs to be able to emplace countermobility obstacles without hindering other engineer unit functions. A properly manned ABCT will have the necessary elements to create countermobility effects for the main effort. The elements in the BEB necessary to operate the MOPM, Volcano, and Spider systems are identical in capability. Each of the three specified land mine systems requires four sections: an element that sites and records the obstacle, an element that marks the obstacle, an element that emplaces the obstacle, and an element that manages the munitions. These four elements require a platoon with at least three squads. Although there are six engineer platoons with technical countermobility knowledge, each platoon should not be expected to emplace countermobility obstacles using FASCAM. There should be enough personnel in the three combat engineer platoons to emplace the three

[37]Army battalion within the ABCT where engineers are located.

mine systems without requiring additional personnel from the clearance platoon or the engineer support platoons.

Similarly, a properly manned MEU can emplace countermobility obstacles without hindering other engineer unit functions. A properly manned MEU is a fully manned GCE with fully manned companies of the CEB according to the MTOE. The CEB needs to be able to emplace countermobility obstacles without hindering other engineer unit functions. A properly manned CEB will have the necessary elements to create countermobility effects. The elements in the CEB necessary to operate the MOPM and Volcano systems[38] are the same four elements discussed for the ABCT. There is also no change to the element size required to support each system: a platoon with at least three squads.

However, the Marines support relationship is different and ensuring a properly manned MEU will have the necessary elements to create countermobility effects for the main effort. Unlike the ABCT where types of platoons are examined, the MEU will require looking at different types of companies. Although there are four engineer companies with technical countermobility knowledge, each company should not be expected to emplace countermobility obstacles using FASCAM because it would affect their other engineer missions. There should be enough personnel in the three combat engineer companies to emplace the three mine systems without requiring additional personnel from the engineer support company or the headquarters and service company.

The goal of the manning research methodology is to determine if there are enough personnel to execute the capabilities required of the four elements in both the ABCT and

[38]Marines are not equipped with the Spider system.

MEU for the MOPMS, Volcano, and Spider minefield.With the reduction of the force, it is possible that engineer units could be double tasked. Although the mission could still be accomplished, risks would be assumed and efficiency would be decreased. The research shows the how the combat engineer platoon if arrayed to execute countermobility operations and what occurs if there are any drastic changes to the force structure.[39] The study also shows if the unit is expected to provide security for itself to include drivers and leadership and the associated mission impacts.

[39]Due to classification levels, numbers will be discussed in generalities. The emphasis is more on the elements capability than on specific personnel numbers

CHAPTER 4

ANALYSIS

This chapter covers the analysis of the study's findings on countermobility. The chapter is divided into sections emphasizing the three main topics from the primary research question: training, equipping, and manning. Analysis of each topic determines if US land forces are properly trained, equipped, or manned to support countermobility operations without conventional mines on a variety of Asia-Pacific battlefields.

Training

Analysis of engineer training determines if the six specified requirements concerning FASCAM systems are taught and to what extent they are taught in formal schooling, additional training, on the job training (OJT), and independent study. The training section demonstrates the strengths and weaknesses of the countermobility curriculum of the USAES and the USMES for both officers and Soldiers. The six FASCAM requirements for effective countermobility are: employment theory or concepts, system components, how to PMCS the system, initiation procedures, retrieval procedures, and troubleshooting procedures.

In order to understand training, doctrine must first be analyzed. Understanding doctrine is important because it shapes the military structure and provides the basis for the way we fight. Table 1 highlights some of the main engineering manuals used in the US Army and the US Marines. Research has been done on past, present, and emerging doctrine to show guidance and linkages in countermobility training amongst the services. The table depicts the comparisons between existing doctrine in the Army, Marine, and

Joint realms with the current publication date.[40] In the past two years, four new or revised manuals have been released. The far right column shows which manuals have been replaced. Publication name of the replaced manuals was left off the chart due to limited column space. The three known future publications are shown through the publication date column, annotated with the term “draft”.

Table 1. Doctrine Comparison

Army	Marine	Joint	Manual title	Publication date	Replaced
ADP 3-90			Offense and Defense	Aug-12	
ADRP 3-90			Offense and Defense	Aug-12	
ATP 3-90.4	MCWP 3-17.8		Combined Arms Mobility	draft	FM 3-34.2, FM 3-90.12, MCWP 3-17.3
ATP 3-90.8	MCWP 3-17.5		Combined Arms countermobility operations	draft	FM 5-102, FM 90-7
FM 20-32			Mine countermine operations	May-98	
FM 3-34	MCWP 3-17		Engineer Operations	Apr 2014 / Feb 2000	FM 5-34, MCRP 3-17A
FM 3-90			Tactics	Jul-01	
FM 3-37			Protection	Sep-09	
GTA 05-11-016			Standard/Situational Obstacle Job Aid	Apr-02	
		JP 3-15	Barriers, Obstacles and Mine Warfare for Joint Operations	Jun-11	Replace April 2007 version
		JP 3-34	Joint Engineer Operations	Jun-11	
TC 20-32-5			CDRs Ref Guide Land Mine and Explosive Hazards (Iraq)	Feb-03	
	MCRP 3-17B		Engineer forms and report	Draft Jan 2010	
FM 3-34.214	MCRP 3-17L		Explosives and Demolition	Aug-08	FM 5-250
	MCWP 3-1		Ground combat operations	Apr-95	FMFM 6
FM 3-34.170	MCWP 3-17.4		Engineer Reconnaissance	Mar-08	FM 5-170
ATP 3-37.34	MCWP 3-17.6		Survivability Operations	Jun-13	FM 5-103, ATTP 3-34.39, MCRP 3-17.6A

Source: Created by author, data obtained from US Army, “Doctrine and Training Publications,” http://armypubs.army.mil/doctrine/index.html (accessed 30 April 2014); US Department of Defense, “Joint Electronic Library,” http://www.dtic.mil/doctrine/new_pubs/jointpub.htm (accessed 30 April 2014); US Marines, “Marine Corps Publications Electronic Library,” http://www.Marines.mil/News/Publications/ELECTRONICLIBRARY.aspx (accessed 30 April 2014).

The table shows that a lot of engineering manuals have or are in the process of being changed and that most Army and Marine engineer doctrine is exactly the same, or at least very similar. However, in some instances the Marines Corps is using older Army doctrine. The reasoning for using the older doctrine was not published in any of the

[40]Information provided on chart is as of 1 April 2014.

sources reviewed. Two examples of older doctrine, based on publication dates, are Marine Engineer Operations doctrine and Marine Ground Combat Operations. Marine Engineer Operations is fourteen years older than Army Engineer Operations Doctrine and Marine Ground Combat Operations was published approximately 20 years ago.

The constant evolution of doctrine will require another review and analysis of the Army publication library and Marine Corp doctrinal publications in 2016 in order to determine which manuals have been replaced, which are in draft, and which are going to be kept. The year 2016 was chosen because of the Army's "Doctrine 2015" initiative. According to the US Army Combined Arms Doctorate Directorate (CADD),[41] there is no current manual, website, or other reference that specifically outlines what manuals are being replaced. CADD's plans for the future are to keep only 50 field manuals. The 380 existing field manuals will be rewritten and turned into Army Techniques Publications (ATP) and Technical Manuals (TM). The Marine publication library is smaller than the Army's version and not quite as organized.[42] As of October 2013, there were roughly 318 Marine Corps publications classified as doctrine. The number of Marine Corps publications barely compares to the number of existing Army field manuals. The Marine Corps plans to also revamp their existing publications. The push for this change comes from the director of the Capabilities Development Directorate at the Marine Corps Combat Development Command, which is working to revise all Marine Corps doctrine.

[41]Confirmed during discussion with a CADD company grade officer on 18 February 2014.

[42]US Marines, "Marine Corps Publications Electronic Library," http://www.Marines.mil/News/Publications/ELECTRONICLIBRARY.aspx (accessed 30 April 2014).

The Marine Corps plan of attack is to incorporate more tactics, techniques, and procedures (TTPs) learned in the last six to ten years of combat operations and use the lessons learned to dictate how Marines train and operate.[43]

Two definite Joint publications specifically apply to this thesis. Although the Joint publication website is well organized and easy to navigate, there may be some publications relating to countermobility that have been overlooked. There is significantly less Joint doctrine because it is approved by the Chairman of the Joint Chiefs of Staff (CJCS) and must be ratified by the services. Even though there is less joint doctrine than service and multiservice doctrine, it is important to the research of countermobility because of joint force development. The CJCS has the authority to "develop doctrine for the joint employment of the Armed Forces, and to formulate policies for the joint training of the Armed Forces to include polices for the military education and training of members of the Armed Forces."[44]

The research comparisons done in this study between Joint, Army, and Marine doctrine have determined there are no current significant doctrine discrepancies concerning countermobility. Since doctrine is one of the drivers of training, the similar countermobility publications in essence leads to common starting points for the Army and Marine forces. Also, since countermobility is executed essentially the same way according to doctrine, the six specified requirements can be equally evaluated in both the

[43]Marine Times, "Marine Corps officials being doctrine overhaul," http://www.Marinecorpstimes.com/article/20131001/NEWS/310010029/Marine-Corps-officals-begin-doctrine-overhaul (accessed 30 April 2014).

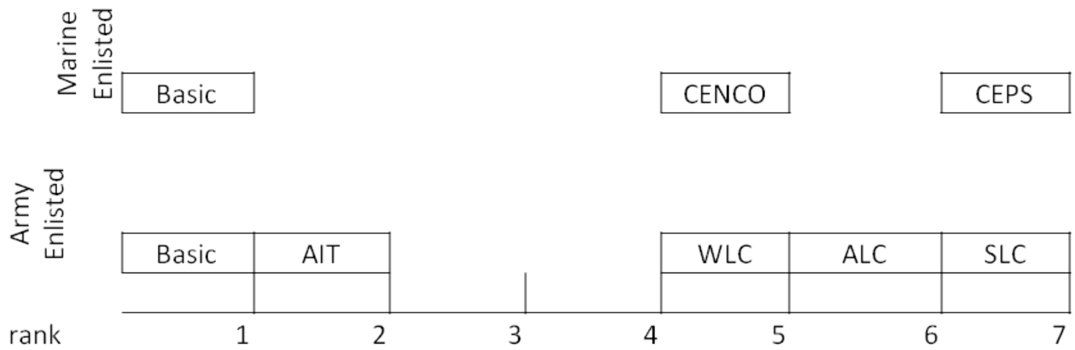
[44]US Department of Defense, JP 1, *Doctrine for the Armed Forces of the United States* (Washington, DC: Government Printing Office, March 2013), xxiv.

Army and Marine Corps. However, with both forces currently attempting to overhaul their existing doctrine, the method that each service will follow in the future for training and achieving countermobility effects could cause divergence among the similar starting points. The possible divergence will require lots of coordination and rehearsals to ensure countermobility operations are not affected.

Table 2 shows the comparisons between the enlisted Army and Marine education systems. The Army MOS researched was the 12 series (engineer).[45] The Marine MOS researched was the 1371 (combat engineer). It is important to note that although a particular MOS was researched, the formal school building blocks are the same for most MOS's. Also worth highlighting: there is almost twice as many required schools for promotion in the US Army than the US Marines. Taking this into consideration, it can be expected that less countermobility training is conducted at the enlisted USMES than the enlisted USAES. It is assumed that the training gap will be made up by a combination of additional training, on the job training (OJT), and independent study. Due to different training techniques, courses of study, and depth of training, the enlisted training for both the Army and Marines will be limited to the ranks of E1 to E7.

[45]Previously coded as 21 series, the MOS was changes to the 12 series in 2011.

Table 2. Enlisted education comparison



Source: Created by author, data obtained from US Army, "Home of the US Army Engineer School and Regiment," http://www.wood.army.mil/usaes/ (accessed 13 May 2014); US Marines, "Combat Engineer Instruction Company," http://www.mces.marines.mil/Units/CombatEngineerInstructionCo.aspx (accessed 13 May 2014). (See Acronyms, page viii-ix, for school identifications.)

A study of the USAES course curriculum and the USMES (Courthouse Bay) was conducted. All Army information was found from manuals, associated web pages, and confirmation with the USAES. All Marine information was found from manuals, associated web pages and some, but not the entire, Courthouse Bay curriculum has been verified with instructors.

The standard progression for Army enlisted engineer schools is basic training, Advance Individual Training (AIT), warrior leader course (WLC), advanced leader course (ALC), and senior leader course (SLC). Between these five mentioned schools, USAES training for scatterable mines consists of little more than five days between the ranks of E1 (private) and E7 (sergeant first class).

As of January 2014 the XM7 Spider mine system was incorporated into Advanced Individual Training (AIT). Soldiers receive a five hour block of instruction on the Spider

mine system covering topics such as operational theory, system components, inspection procedures, and steps for installation. The first set of graduates completed the AIT course in March 2014.[46] Soldiers who complete AIT are not trained to standard based on the metric established in chapter three. The comparison of what the Soldiers learn to what they have been taught in AIT is shown in table 3. At WLC, there is no specific scatterable mine training. At ALC, there is a four hour block where the Spider mine system capabilities, characters, and how system employment is taught. No hands-on training occurs during this lesson, minus one component, the Munition Control Unit (MCU). Also taught at ALC are the dimensions, number of canisters, and minefield composition for the MOPMS and Volcano system; again no hands-on training. At SLC, the same four hour lesson given at ALC is re-taught as a refresher.[47] Table 3 shows the six main FASCAM training requirements and which training requirements are taught at AIT, ALC, and SLC. Of the six specified requirements, only three training requirements are consistently met in the USAES house. The other three must either be gained through professional development: additional training, OJT, or independent study.

[46]US Army, "Engineers train with SPIDERs," http://www.Army.mil/article/121030/ (accessed 30 April 2014).

[47]Confirmed during discussion with a senior NCO cadre for ALC and SLC on 10 March 2014.

Table 3. Army Enlisted FASCAM training

FASCAM training	AIT	ALC	SLC
Employment theory/concepts	x	x	x
System components	x	x	x
PMCS	x		
Initiation procedures	x	x	x
Retrieval procedures			
Troubleshooting procedures			

Source: Created by author, data obtained from US Army, "Engineers train with SPIDERs," http://www.Army.mil/article/121030/ (accessed 30 April 2014); US Army, "Engineers Advanced Leader Course," http://www.wood.army.mil/newweb/mncoa/eng_alc.html (accessed 30 April 2014); US Army, "Engineers Senior Leader Course," http://www.wood.army.mil/newweb/mncoa/eng_slc.html (accessed 30 April 2014).

The two Marine Corps enlisted schools after basic training that are relevant to this study are the Combat Engineer Noncommissioned Officer Course (CENCO) and the Combat Engineer Platoon Sergeant Course (CEPS). The FASCAM systems taught during these two courses are ADAM/RAAM, GEMSS, MOPMS, and Gator/Volcano. The Spider system may be discussed during formal training, but is not an official part of the course lessons. The CENCO course is geared toward Corporals (E4) and Sergeants (E5). During the course, Marines are taught obstacle placement, obstacle planning, how to build an obstacle, and landmine warfare. Other than through powerpoint presentations, students neither see nor touch any FASCAM systems. The CEPS course is focused toward Staff Sergeants (E6) and Gunnery Sergeants (E7). During the course, Marines are taught explosive hazard identification, obstacle planning, tactics, techniques and procedures (TTPs), and when to deploy FASCAM for area denial and lane closure.[48]

[48]Confirmed during discussion with a Marine Engineer School Training Specialist on 24 April 2014.

Table 4 shows the six main FASCAM training requirements. Of the six, only two training requirements are consistently met in the required USMES. The other four must be gained through professional development: additional training, OJT, or independent study. While the enlisted Army Soldier is trained on half of the requirements, the enlisted Marine is trained on one third of the requirements.

Table 4. Marine Enlisted FASCAM training

FASCAM training	CENCO	CEPS
Employment theory/concepts	x	x
System components	x	x
PMCS		
Initiation procedures		
Retrieval procedures		
Troubleshooting procedures		

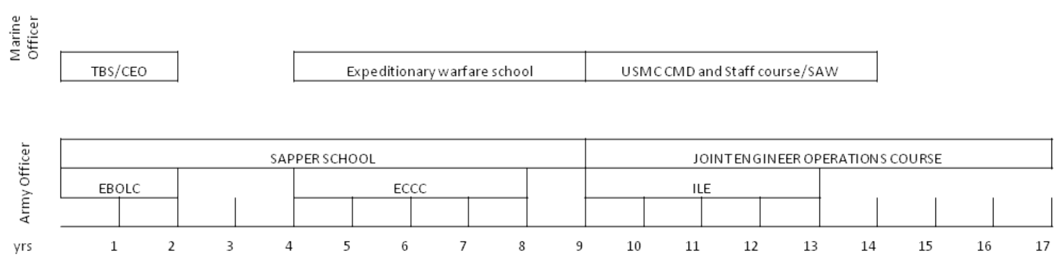
Source: Created by author, data obtained from US Marines, "Combat Engineer Instruction Company," http://www.mces.marines.mil/Units/CombatEngineer InstructionCo.aspx (accessed 13 May 2014).

Additional countermobility training is covered in two parts: specialty courses and mobile training teams. Specialty courses are covered following the formal OES. By exception there is a 40 hour block of instruction that Soldiers can attend taught by the mobile training team from Picatinny Arsenal. These courses are intended for NCOs to be certified as train-the-trainers. As of right now, it is not a requirement for each ABCT to have a train-the-trainer in the brigade. The course covers the six FASCAM training requirements for the Spider System: employment theory or concepts, system components, PMCs, initiation procedures, retrieval procedures and troubleshooting procedures.

However, research has been unable to identify a train-the-trainer course for the Volcano and MOPMS. Therefore, the chances of finding a thoroughly trained Soldier or NCO on the three FASCAM systems at a particular unit is unlikely.

Table 5 shows the comparisons between the Army and Marine officer education system. The Army MOS researched was the 12A series[49] (engineer officer). The Marine MOS researched was the 1302 (combat engineer officer). Unlike the enlisted formal school training, US Army and US Marine officers take similar courses that are required for promotion. From a holistic perspective, the chances of receiving countermobility training are equivalent.

Table 5. Officer Education comparison



Source: Created by author, data obtained from US Department of Defense, DA PAM 600-3, *Commissioned Officer Professional Development and Career Management*, (Washington, DC: Government Printing Office, February 2010); US Marines, "Marine Corps Engineer School, Training and Education Command," http://www.mces. Marines.mil/ (accessed 30 April 2014). (See Acronyms, page viii-ix, for school identification.)

[49]MOS series 12A absorbed MOS series 12B and 12D in October 2013.

The standard progression for Army officer engineer schools is engineer basic officer leader course (EBOLC), engineer captain career course (ECCC), intermediate level education (ILE). The first of these three mentioned schools is EBOLC, also known as engineer officer basic course (EOBC). At EBOLC, US Army lieutenants receive a three hour block of instruction on the basics of mines. This instruction block is meant to introduce lieutenants to the scatterable mine types, effects, frontage and depth, calculations, and required man hours. A roughly two hour block of instruction is set aside to discuss coordination, employment, and use in a brigade scheme of maneuver and at the task force level. There is no hands-on training conducted and officers are only shown pictures of the equipment.[50]

At the career course, a more thorough training on FASCAM is conducted. The Volcano and MOPMS systems are taught during an integrated week long session of instructions and practical exercises. Later, the Spider system is taught during an hour of classroom instruction and then touched upon during two hours in engagement area (EA) development and practical exercises. The practical exercises are conceptual, not hands, even though systems components are present.[51]

Table 6 shows the six main FASCAM training requirements. Of the six training requirements, four are taught to engineer officers at the USAES. The other two requirements, PMCS and troubleshooting procedures, must be learned through professional development: additional training, OJT, or independent study.

[50]Confirmed during discussion with Company grade cadre from the basic course on 10 March 2014.

[51]Confirmed during discussion with Company grade cadre from the career course on 10 March 2014.

Table 6. Army Officer FASCAM training

FASCAM training	BOLC	CCC
Employment theory/concepts	x	x
System components	x	x
PMCS		
Initiation procedures	x	x
Retrieval procedures		x
Troubleshooting procedures		

Source: Created by author, data obtained from US Army, "Engineer Basic Officer Leader Course," http://www.wood.army.mil/USAES/EBOLC.html (accessed 13 May 2014); The Free Library, "Developing Adaptive Leaders for Full Spectrum Operations: The Engineer Captains Career Course," http://www.thefreelibrary.com/Developing+adaptive+ eaders+for+full-spectrum+operations%3a+The...-a0176473774 (accessed 13 May 2014).

The standard progression for Marine officer engineer schools is the basic school (TBS), combat engineer officer (CEO), expeditionary warfare school (EWS), command and staff, and school of advanced warfare (SAW). Between these five mentioned schools, the two officer courses conducted by the Marine Engineers School Training and Education (Courthouse Bay) that apply to this study are the Basic Officer course, also called the Combat Engineer Officer, and the Expeditionary Warfare School. The command and staff course and naval post graduate are not taught at Courthouse Bay and are not considered an engineer skills progression course. The school of advanced warfare falls outside the rank of study for this thesis. The CEO course is roughly 89 school days (115 calendar days) and taught to 2nd lieutenants (O1) and 1st lieutenants (O2). During the course, Gator/Volcano, ADAM/RAAM, and MOPMS are taught. The focus of countermobility is obstacle planning, area denial, and self destruct times. No hands-on training occurs during the course; however, a couple of the system components have been

turned into models to augment the powerpoint presentations.[52] The EWS course[53] is a nine month course taught to captains (O3). Countermobility is taught during the second of five major segments. During segment two, Marine Air Ground Task Force (MAGTF) operations ashore, students are taught combined arms integration concepts and GCE defensive operations.[54] Based on the curriculum, only employment theory and concepts are covered during EWS.[55] The USMES bases its training on doctrine and equipment currently in their inventory. The Spider system has not been fielded yet to the US Marine Corps; therefore it is not a part of their course instruction. Table 7 shows the six main FASCAM training requirements. Of the six training requirements, two are formally taught to engineer officers at USMES. The other four requirements must be learned through professional development: additional training, OJT, or independent study.

[52]Confirmed during discussion with a Marine Engineer School Training Specialist on 24 April 2014.

[53]EWS was formed in 2002 from two schools Amphibious Warfare School (AWS) and Command and Control Systems Course (CCSC).

[54]Department of Defense, *2013 Expeditionary Warfare School Handbook*, 3-3 to 3-5.

[55]No confirmation with USMES on countermobility curriculum taught at the expeditionary warfare school.

Table 7. Marine Officer FASCAM training

FASCAM training	CEO	EWS
Employment theory/concepts	x	x
System components	x	
PMCS		
Initiation procedures		
Retrieval procedures		
Troubleshooting procedures		

Source: Created by author, data obtained from US Department of Defense, *Expeditionary Warfare School Handbook* (Washington DC: Government Printing Office, 2013); US Marines, "Marine Corps Engineer School, Training and Education Command," http://www.mces.Marines.mil/ (accessed 30 April 2014).

Specialty schools that the Army officer can attend with the potential of learning countermobility are the Army Sapper Leader Course, the Marine Sapper Course, the Area Clearance Course, and the Joint Engineer Operations Course. The Army and the Marines both have a specialty course called Sapper, but it is not a required course for promotion. The Army Sapper Leader Course is restricted to enlisted Soldiers with the rank of E4 through E8 and officers with the rank of O1 to O3.[56] Although there is a threat mine module during phase one of the 28 day course,[57] the training focus is geared mainly toward assured mobility versus countermobility. The course is rapid-paced and FASCAM training is not a key element for light engineers. The students are taught foreign mine identification and explosives hazards, mainly IEDs. The countermobility that is executed

[56]There are current discussions about rank restrictions changing. Nothing official has been published as of 01 April 2014.

[57]US Army, "Sappers Clear the Way," http://www.goArmy.com/soldier-life/being-a-soldier/ongoing-training/specialized-schools/sapper-leader-course.html (accessed 30 April 2014).

during the patrol phase is a hasty road crater[58] and includes both calculations and setup. Although Army Sapper Leader Course is a specialty engineer course, minimal mine warfare is conducted to expand the Soldiers countermobility knowledge.[59] Similarly, the Marine Sapper Course is open to all MOS's and mine warfare is taught during phase four of the six week course.[60] The Marine Sapper Course also has minimal mine warfare training conducted to expand a Marine's countermobility knowledge.

It was initially believed that the Area Clearance Course offered training on the six FASCAM requirements: employment theory or concepts, system components, how to PMCS the system, initiation procedures, retrieval procedures, and troubleshooting procedures, but research indicated only three of the six requirements were addressed. The Area Clearance Course, taught by a civilian team, is one of twelve courses taught by the Counter Explosive Hazards Center (CEHC) at Fort Leonard Wood, Missouri.[61] The mission of the CEHC is to "serve as the center of expertise regarding current and future explosive hazards in order to support the warfighter, protect the force, assure mobility, and enable victory during irregular and conventional warfare."[62] The Area Clearance

[58]In this context, a road crater is an obstacle created using demolition to hinder vehicular movement.

[59]Confirmed during discussion with Company grade officer from SAPPER leader course on 22 Apr 14.

[60]About.com, "Marine Corps Sapper Training," http://usmilitary.about.com/cs/Marinetrng/a/Marinesapper.htm (accessed 30 April 2014).

[61]US Army, "Counter Explosive Hazards Center Course Information," http://www.wood.Army.mil/usaes/cehc_training.html (accessed 30 April 2014).

[62]US Army, "Counter Explosive Hazards Center," http://www.wood.Army.mil/usaes/cehc.html (accessed 30 April 2014).

Course is restricted to sergeant (E5) through 1st lieutenant (02) and the curriculum includes international mine action standards (IMAS), technical surveys, detection techniques, and defeat explosive hazard threats.[63] One benefit of the course is that CEHC has numerous conventional and FASCAM munitions on-hand. Although not part of CEHCs training objectives, it is possible for Soldiers to learn elements of FASCAM theory or concepts, system components, and retrieval procedures during the course.

The Joint Engineer Officer Course (JEOC) is offered at various locations around the world. Only 45 students, mostly engineers, are selected to attend each course and they must be a senior captain (O3) to a junior major (O4), or a senior non-commissioned officer. JEOC consists of two phases, a distributed learning phase with seven modules and a weeklong resident phase consisting of seminars, practical exercises, and guest speakers. Two of the modules during the distance learning phase and two of the modules during the resident phase are applicable to countermobility. The modules applicable to countermobility are joint engineer capabilities, theater engineer operations, service engineer capabilities, and engineer functions.[64] Presentations and discussions occur during the course, but no hands on FASCAM training occurs during the course. All of the six required FASCAM training requirements of this thesis are not covered in enough detail during JEOC to warrant improving countermobility education.

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[63]Confirmed during discussion with CEHC training coordinator on 29 April 2014.

[64]US Navy, "Joint Engineer Operations Course," https://www.netc.navy.mil/ centers /csfe/cecos/CourseDetail.aspx?CID=92 (accessed 30 April 2014).

Table 8. Additional Engineer Training courses

FASCAM training	Sapper	ACC	JEOC
Employment theory/concepts	x	x	
System components		x	
PMCS			
Initiation procedures			
Retrieval procedures		x	
Troubleshooting procedures			

Source: Created by author, data obtained from US Army, "Counter Explosive Hazards Center," http://www.wood.Army.mil/usaes/cehc.html (accessed 30 April 2014); US Army, "Sappers Clear the Way," http://www.goArmy.com/soldier-life/being-a-soldier/ongoing-training/specialized-schools/sapper-leader-course.html (accessed 30 April 2014); US Navy, "Joint Engineer Operations Course," https://www.netc.navy.mil/centers/csfe/cecos/CourseDetail.aspx?CID=92 (accessed 30 April 2014).

Table 8 shows that the three researched engineer courses for officers and NCOs offer minimal FASCAM training. The JEOC offered no FASCAM training and the Sapper Leader Course for both the Army and Marine Corps only trained on employment theory and concepts. The Area Clearance Course has the most opportunity for FASCAM training, briefly covering three of the six required metrics.

Formal education for both the Army enlisted and officer ranks lacks the necessary prerequisites to effectively use FASCAM systems. The Marine Corps engineer course barely teaches half of the prerequisites to use FASCAM systems. All three of the Army engineer specialty schools and the Marine Corps specialty school fail to effectively improve Soldiers countermobility knowledge on FASCAM system. The only additional training that covers all of the six metrics is the Spider system train-the-trainer, but that is just one of the three systems being evaluated. Due to inadequate preparation, engineers will need to further their knowledge through OJT or independent study.

Equipping

The equipping section offers historical examples of units with and without mine systems, current approved DoD mine systems to include the mine systems duration and emplacement authority, number of systems within a ABCT by type, rough calculations on the effects that the current systems can create, and future countermobility systems.

Historical examples are used from battles in the Philippines during World War II, the Korean War, and the Vietnam War. During World War II, battles on the island of Luzon occurred for roughly five months. There were no FASCAM systems available during World War II, but conventional mines and demolitions were used to achieve countermobility effects.

The Philippines consist of roughly 7,000 islands with 11 main islands. The capital of the Philippines, Manila, is located on the island of Luzon. Luzon was the western-most US outpost located roughly 5,000 miles from Pearl Harbor, Hawaii. The defense plan, War Plan Orange, consisted of the US forces and Philippine forces holding out for six months until reinforcements could arrive.

The “most strategically important defensive region”[65] of General Douglas MacArthur’s four separate forces was the North Luzon Force. The North Luzon Force commander was Major General Jonathan M. Wainwright. MG Wainwright’s force consisted of the 26th Cavalry Philippine scout regiment, the 45th infantry battalion Philippine scouts, the 11th Infantry Division (ID) Philippine Army, the 21st ID Philippine Army, and the 31st ID Philippine Army. One of the areas in MG Wainwright’s sector

[65]Jennifer L. Bailey, CMH Publication 72-3, *Philippine Islands: The US Army Campaign of World War II* (Washington, DC: Center for Military History, 1987).

was the Cagayan valley. MG Wainwright recognized the significance of the area, as there was only one route south through the valley. MG Wainwright initially dedicated a battalion to the defense. He used overwatching positions combined with obstacles and existing terrain. Obstacles were created with the assistance of the Bureau of Public Works. The Bureau of Public Works created road blocks and mined the roads.[66] Capitalizing on the terrain since the area favored the defender. Later, MG Wainwright's 11th ID Philippine Army destroyed bridges through the Cagayan Valley and established a blocking position at the Balete pass.[67]

This historical example shows countermobility through the use of manmade and natural obstacles to create a blocking position at the Balete pass in the Cagayan Valley. Three of the four categories of natural obstacles were used: vegetation, water features, and surface configuration. Both explosive and non-explosive obstacles were used from the manmade obstacle category. The obstacles were tied into weapons systems that overwatched the obstacles. The area and obstacles created were moderately effective and they were used again by the Japanese during their defense of Luzon.[68] However, there was a problem with quantity of landmines available in the Philippines. In order to overcome the shortage of anti-tank mines, makeshift landmines were used. Makeshift mines consisted of "a wooden box about ten inches on a side, with approximately five

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[66]Karl C. Dod, CMH Publication 10-6, *United States Army in World War II, The Technical Services, The Corps of Engineers: The War Against Japan* (Washington, DC: Center for Military History, 1987), 65-66, 74.

[67]Louis Morton, CMH Publication 5-2-1, *Fall of the Philippines* (Washington, DC: Center for Military History, 1993), 104-105.

[68]Bilingual Pen, "Remembering the Battle of Balete Pass," http://bilingualpen.com/2009/06/18/remembering-the-battle-of-balete-pass/ (accessed 30 April 2014).

pounds of dynamite, a flashlight battery, and a detonator, each mine was put together and placed by the troops."[69] Today's forces equipped with the Volcano system would have created a more effective anti-tank obstacle resulting in further enemy delay and attrition.

Later, MG Wainwright's forces took up a "series of defensive lines"[70] in order to allow a withdrawal of the South Luzon force. This defense was held for approximately 12 days before all forces took up their deliberate defensive positions in the Bataan peninsula. In Bataan, defensive forces were organized into two lines. The eastern line was commanded by MG Wainwright "across the peninsulaa from Mauban in the west to Mabatang in the east"[71] and the western line which was commanded by Brigadier General George M. Parker, Jr., with Mount Natib in the center, acting as the boundary. MG Wainwright's forces along the eastern defensive line were the 1st ID Philippine Army, the 31st ID Philippine Army, the 91st ID Philippine Army, the 26th Cavalry Philippine scout regiment, and a battery of field artillery and self-propelled 75mm guns.

The countermobility consisted of manmade and natural obstacles. Use of vegetation and surface configuration were incorporated into the defense system. The forces used vegetation by clearing fields of fire and then reusing trees as obstacles to slow enemy vehicles. The allied forces also heavily used protective obstacles, placing anti-tank mines and 25 tons of wire "in front of the main line of resistance." [72] Finally,

[69]Dod, CMH Publication 10-6, 75-76.

[70]Bailey, CMH Publication 72-3, 15.

[71]Ibid.

[72]Dod, CMH Publication 10-6, 88.

the allied forces tied their built gun emplacements into non-explosive obstacles, tank traps.

JP 3-15, *Barriers, Obstacles, and Mine Warfare for Joint Operations* states, "barriers, obstacles, and minefields are usually formed around or tied into an existing terrain feature . . . reinforcement is achieved by integrating systems of barriers, obstacles, minefields, and fires."[73] Logically it made sense for MG Wainwright's forces to tie into Mount Natib, a 1287 meter tall mountain covered with heavy forests of hardwood trees. Mount Natib was an existing terrain feature that both eastern defensive line and western defensive line could connect. However, both forces did not reinforce their defensive lines very far up the mountains slopes or extend far enough over to tie into each other's defensive lines.[74] Assuming the division received their requested engineer supplies,[75] if the forces had used countermobility effects on Mount Natib to protect their flanks, they possibly could have delayed if not prevented the enemy infiltration on 22 January.

The use of today's FASCAM systems in the examples of countermobility used during World War II in the Philippines would have taken ingenuity and adaptability because of the dense vegetation. The Volcano mine system or air dropped munitions would have been of little benefit or use. MOPMS would have limited use based on clearings and space between trees and brush, but could be used in place of conventional anti-tank landmines. The main battle position cleared fields of fire and used trees and mines for obstacles and anti-tank traps. Most likely the area was smaller to create a choke

[73]US Department of Defense, JP 3-15, 12.

[74]Ibid., 16.

[75]Morton, CMH Publication 5-2-1, 35.

point, using the Spider system combined with the other allied forces defenses would effectively deny access to personnel avenues of approaches. Thus, an ABCT would be more effective than a MEU because of its organic MOPM and Spider system. However, much like MG Wainwright's forces, the units conducting the defense would have to be properly equipped with the right systems and multiple reloads to be effective.It takes all four MOPMS in a Company to create a fix minefield. If the ABCT used the MOPM and Spider systems at the Balete pass, they would not be as effective at the main defensive line due to quantities available.

The second example of countermobility use is the Korean War. The Korean War began on June 25, 1950, when the North Korea People's Army crossed the 38th parallel in the Republic of South Korea. On July 5, 1950, President Harry S. Truman "authorized General MacArthur to use all forces available to him."[76] General MacArthur sent forces in several areas to delay North Korean movement south. These forces were the first troops "designated to go into Korea by air"[77] and one such force was Task Force Smith. Task Force Smith consisted of two rifle companies, an artillery battery, and a few other supporting units of the 24th Infantry Division totaling approximately 540 personnel. Task Force Smith took up a defensive position on July 5, 1950, "astride the main road near

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[76]William G. Bell, Robert W. Coakley, Stetson Conn, Benjamin F. Cooling, Vincent H. Demma, Walter G. Hermes, Vincent G. Jones, Charles B. MacDonald, Morris J. MaGregor Jr., Maurie Matlloff, Lida Mayo, BC Mossman, Charles F. Romanus, and Paul J. Schieps, CMH Publication 30-1, *American Military History* (Washington, DC: Center for Military History, 1989), 548.

[77]T. R. Fehrenbach, *This Kind of War: The Classic Korean War History* (Washington, DC: Potomac Books Inc., 1963), 65.

Osan, ten miles below Suwon."[78] The area chosen for a defense was "low rolling hills on a ridge that ran at right angles to the road."[79] The hilltop was the highest point in the area, almost 300 feet above the nearby main avenue of approach, and offered excellent observation. The forces were integrated into generally three defensive areas: the Republic of Korea forces, followed by the US infantry dug into the hills, followed by the artillery.

At about 0800 on July 5, 1950, the first North Korean forces appeared. Had there been engineers, conventional anti-tank rounds would have stopped the armor forces. However, "there was not a single anti-tank mine in Korea."[80] Unfortunately it was raining on July 5, 1950, which prevented air support, the outdated and insufficient ammunition did little to the North Korean T-34s, and the lack of countermobility allowed the North Korean T-34s to keep moving along the axis of advance.

The integrated prepared defensive positions augmented by mortars and crew served positions worked well for unarmored vehicles (trucks) and North Korean forces marching in columns on the road. However, lack of communication with the artillery battery and between Task Force Smith's companies allowed the enemy infantry to attack Task Force Smith's flanks during their withdraw. Task Force Smith defensive position had delayed the North Korean movement south by just seven hours.[81]

Although the task force was undermanned, had limited ammunition, and limited equipment, a better defensive plan could have achieved the mission intent. This event is

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[78]Bell, CMH Publication 30-1, 549.

[79]Fehrenbach, *This Kind of War*, 66.

[80]Ibid., 67.

[81]Ibid., 71.

clearly an example of an ill-equipped unit facing an enemy force. However, the Task Force could have created countermobility effects such as disrupting vehicles movement with manmade non-explosive obstacles such as wire, berms, rocks, and vehicles hulks.

In the example above, today's use of FASCAM systems would have been very effective for their defensive positions. Although in this situation it was raining and air dropped munitions could not be used, artillery fired munitions and the MOPMS would be very effective for a defense against armored vehicles. Due to the specific vehicle requirements of the Volcano system, it would be significantly easier transporting the MOPMS system for a rapid deployment. Additionally, augmenting the weapons systems with protective obstacles such as wire and other manmade obstacles or the Spider system would have created countermobility effects on not just the vehicles, but the enemy infantry as well. These examples of countermobility available to today's ABCT and MEU show that both units are equipped to further reinforce the task forces' defensive positions. However, there is only hand emplaced system that can stop armor vehicles and it takes all four within the Company to create one effect.[82]

The final example of historical countermobility use will be the Vietnam War. The first use of countermobility discussed is the defense of Cam Rahn Bay on July 29, 1965. The concept was "ground combat troops with their supporting engineers were able to fight the enemy from well-established bases."[83] The engineers quickly realized that the ground in the Cam Ranh peninsula was different from the previous areas they occupied.

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[82]All four MOPMS are needed to create a fix minefield.

[83]Adrian G. Traas, CMH Publication 91-14, *Engineers at War: The United States Army in Vietnam* (Washington, DC: Center for Military History, 2010), ix.

This was significant as a large portion of countermobility was barbed wire and defensive berms. In order to soften the dirt, road cratering charges were used prior to digging.[84]

The iron triangle saw increased countermobility from both the US forces and the Viet Cong forces. The 70th Engineer Battalion and the 8th Engineer Battalion worked together to create an effective area denial.[85] The obstacle system consisted of "four layers of barbed wire fences, a layer of claymore antipersonnel command-detonated mines, and inner and outer cattle fences."[86] The area was also cleared of vegetation, and 1,032 lights on concrete poles plus 68 guard towers with searchlights were added.

The opposing Viet Cong areas were defended with a series of three defensive systems. The first defense was ditches and other obstacles along main avenues of approach. The second defense was trench systems supported by heavy machine guns. The Viet Cong's last line of defense was "sharp wooden punji stakes, five foot deep trenches with firing ports, bunkers, and occasionally barbed wire."[87]

The Viet Cong were more effective with their mine use for countermobility. The Viet Cong effectively disrupted main supply routes and avenues of approach of the multinational forces. The Viet Cong also reused US forces antipersonnel mines by recovering and relocating found US mines. The Viet Cong buried "fragmentation bomblets" in roads under construction, making them harder to detect. The Viet Cong also

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[84]Ibid., 58.

[85]US Department of Defense, JP 3-15, 12-13.

[86]Traas, CMH Publication 91-14, 65.

[87]Ibid., 70.

watched mine sweeper teams and would bury mines after the teams passed.[88] Conversely, the US forces were not effective with their mine use for countermobility. The fragmentation bomblets used by the Viet Cong were most likely air delivered FASCAM with no overwatch. This type of minefield is the least effective and as mentioned earlier allows the enemy not only to breach the obstacle created, but pick-up and reuse the munitions. During this time US forces also used the plastic M14 landmine and the M16 “bouncing betty”.[89] Both of these landmines are conventional antipersonnel landmines. The challenges that US forces faced were, minefields were not well marked or recorded and mine detectors did not work effectively on plastic. Thus, the US inflicted their own casualties due to unknown countermobility obstacles.

In the above example, today’s FASCAM systems of both the ABCT and MEU would have improved the effects of the multinational forces countermobility. The FASCAM systems of today are better equipped with anti-handling/trip wires to prevent mines from being picked up and reused by enemy forces. Additionally, minefields are now marked and their positions can be entered into systems such as CPOF to give all units operating in the area better situational awareness. If the ABCT was used, the reusable nature of the Spider system would allow forces to emplace obstacle systems to the flanks of road construction and then move them as the work progresses. A prepared unit should be equipped to overcome the challenges faced by the forces in Vietnam.

A table has been developed to show what munitions are currently available in the US inventory. Table 9 shows the comparisons between conventional mines and

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[88]Ibid., 170.

[89]Ibid., 58.

FASCAM. Several munitions were deleted from the chart because they are no longer in use by the US DoD. These systems include the M62 ADAM, M93 WAM, M723 RAAM, and the M1023/4/5/6 RADAM. If the ABCT operates without Air Force support, but with organic air support and field artillery, it would have the potential of either two Volcano systems, either four types of ADAM/RAAM, either three types of MOPMS, and the Spider system. If a MEU operates without Air Force support it would have the potential of either two Volcano systems, either four types of ADAM/RAAM, either two types of GEMSS, and either three types of MOPMS. Included in the chart is the Gator system (supplied by the Air Force) for situational awareness. However, it will not be analyzed.

Table 9. FASCAM Comparison

FASCAM (Family of scatterable mines)

						4hr, 48hr, 5day, 15day
Munition	Acronym	Description	Area it can affect	Time to employ	Approval authority	Duration
BLU 91/B	GATOR (AT)	USAF	200x650	2min	corp, theater, army	4hr, 48hr, 15day
BLU 97/B	GATOR (AP)	USAF	200x650	2min	corp, theater, army	4hr, 48hr, 15day
M56	Air volcano (AP/AT)		140x278	4min/2.5min	unit cdr of aircraft	4hr, 48hr, 15day
	Ground volcano (AP/AT)	10mins	120x277	4min/2.5min		4hr, 48hr, 15day
M67	ADAM (AP)	Area denial artillery		45sec/2min	corps to TF	4hr
M70	RAAM (AT)	Remote anti-armor mine		45sec/2min	corps to TF	4hr
M72	ADAM (AP)	Area denial artillery		45sec/2min	corps to BDE	48hr
M73	RAAM	Remote anti-armor mine		45sec/2min		48hr
M74	GEMSS (AP)	Ground emplaced mine scattering system		40-60sec	corps to BDE	5day, 15day (24hr or longer)
M75	GEMSS (AT)	Ground emplaced mine scattering system			corps to BDE	5day, 15day
M76	MOPMS (AT)	Modular pack mine system	~ 85m (fig 6-19)	2min	co cdr or base cdr	4hr (recycle up to 3x)
M77	MOPMS (AP)	Modular pack mine system	~ 85m (fig 6-19)	2min	co cdr or base cdr	4hr (recycle up to 3x)
M131	MOPMS	Modular pack mine system	~ 85m (fig 6-19)		co tm or base cdr	
XM7	SPIDER		100x45	considered wpn sys, no release auth		14day if lines out
XM1100	SCORPION	experimental				
M15	AT					conventional
M19	AT					conventional
M21	AT					conventional

Source: Created by author, data obtained from US Department of Defense, FM 5-34, *Engineering Field Data* (Washington, DC: Government Printing Office, July 2005); US Department of Defense. JP 3-15, *Barriers, Obstacles, and Mine* (Washington, DC: Government Printing Office, June 2011); US Department of Defense. MCWP 3-17, *Engineering Operations* (Washington, DC: Government Printing Office, February 2000).

This study's research has not shown Marine policy differing in FASCAM approval authority or duration from the Army. The Spider mine system does not have a designated release authority like the other munitions. In this aspect it is similar to the conventional mine. The MOPMS (M76, M77, and M131) release authority is the Company Commander. The M67 and the M70 (ADAM/RAAM) can be delegated down to the task force level and the M72, M74, and M75 (ADAM and GEMMS) can be delegated down to the brigade. This shows that even if a unit is equipped, it still requires higher level authority to use the FASCAM systems. The approval authority, although delegated for first time use, is often kept at higher level commands for releasing FASCAM munition resupply.

Understanding mine systems is incomplete without an understanding of how many there are within a unit. There are only two Engineer Companies (sapper) within the Brigade Engineer Battalion (BEB). There is also only one BEB within the ABCT. The only engineer capabilities within the ABCT are in the Sapper Companies. Between the two sapper companies they will have approximately three Volcano systems, eight MOPMS, and maybe zero Spider systems.[90]

Both the ABCT and MEU are equipped with the Volcano and MOPMS system. A fix minefields dimensions are 250m by 150m.[91] One Volcano system can lay approximately four fix minefields. Volcano systems have four panels and can lay a total

[90]Roughly one Volcano system per line platoon; one MOPMS per platoon counting HQ; Spider systems are still being fielded.

[91]US Department of Defense; FM 5-34, *Engineering Field Data* (Washington, DC: Government Printing Office, July 2005), 7-1.

area of 1115m x 140m.[92] The minefield is completed by using the MOPM system. Solely using the MOPMS, it would take all four systems within the company to create one disrupt minefield.[93]

The DoD is spending millions of dollars to improve alternatives to conventional landmines. Congress appropriated the following amounts from fiscal year (FY) 2012 to 2015: FY 2012- $9 million, FY 2013 - $14 million, FY 2014 - $15 million, FY 2015 - $7 million.[94] No money was appropriated for FY 2011 and no money has been appropriated from FY 2016 and FY 2017.[95] One area denial weapon which has not been fielded yet is the Selectable Lightweight Attack Munition (SLAM). SLAM is a hand-emplaced munition that is currently being developed by Project Manger Close Combat Systems (PM CCS).[96] The XM1100 Scorpion mine system designed by Textron defense systems was incorporated into the Spider Increment II program.[97] No additional systems from either the PM CCS or ERDC have been identified.

92US Department of Defense. FM 5-34, 7-9.

93US Department of Defense, FM 5-34, 7-10 and 7-11. It would take 5 MOPMS to create the effect of a fix minefield.

94Amounts are rounded to the nearest million.

95Defense Technical Information Center, "Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army," http://www.dtic.mil/descriptivesum/Y2013/Army/stamped/0604808A_5_PB_2013.pdf (accessed 20 May 2014).

96Project manager close combat systems, "PdM Area Denial," http://www.pica.army.mil/pmccs/AreaDenial/LegacyMines.html#nogo08 (accessed 20 May 2014).

97Defense Technical Information Center, "Exhibit R-2, RDT&E Budget Item Justification: PB 2013 Army."

More comparison needs to be conducted to find out the official Department of Defense policy towards use of AP mines in FASCAM. Joint Publication 3-15, *Barriers Obstacles and Mine Warfare*, states mines are "governed by international law and US laws and policies. The United States regards mines as lawful weapons when employed in accordance with accepted legal standards."[98] However, current Joint publications, Army publications, and Marine publications do not state anything about AP mines not being able to be used in conjunction with AT mines or AP FASCAM no longer being acceptable. It is known that "The Secretary of State and ambassadors obtain permission from host nation for employment of mines within their territories or waters."[99] However, another area that still needs to be developed is whether or not the legal policies of Korea, Vietnam, and Philippines support the United States military use of FASCAM that has an AP mix or straight AP mines.

Manning

The Department of Defense as a whole is reducing its force structure. The reduction will play a large part in the US Army and the US Marines, specifically engineers and their ability to accomplish various and diverse missions. Compounding issues arise due to the fact the government is implementing changes, in addition to the force structure reductions of Army Combat engineers, and the process of fielding new equipment. The manning section analyzes whether US Army and US Marine combat engineers are properly manned to accomplish the countermobility missions without

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[98]US Department of Defense, JP 3-15, 11.

[99]Ibid.

conventional mines. This is accomplished through illustrating the capabilities of the four elements necessary to emplace FASCAM systems effectively.

The active duty Army is reducing its forces from 570,000 personnel to 450,000 personnel by fiscal year 2017. This decrement is a reduction of 120,000 personnel. The Marines are reducing their forces from 240,000 personnel to 182,000 personnel, a reduction of 68,000 personnel.[100] Even if engineers are only reduced 1 percent of the total force decrement, roughly 1,880 engineers from the active duty Army and Marines corps will no longer be present to conduct countermobility. This plays a huge part in missions when considering how engineer units are organized to support their higher headquarters.

In the Army, the Brigade Engineer Battalion (BEB) supports the Armor Brigade. Since there are only two engineer companies in the BEB, it cannot dedicate a company to each of the maneuver battalions, much less keep a company as a Brigade reserve. Additionally, the companies are not mirrored like the Marine Corps companies. The total platoon structure within the BEB consists of three combat platoons, one reconnaissance platoon, and two engineer support platoons. Just in observing the naming convention of the platoons, it is obvious that each platoon has a specific capability needed to accomplish the various engineer missions. The platoons most likely to be conducting countermobility are the three combat platoons. Thus, a fully manned BEB can emplace three countermobility obstacles for the ABCT.

Within the MEU the Marine Combat Engineer Battalions (CEB) are manned to conduct countermobility operations such as placing mines. Marine CEBs, Engineers

[100]Department of Defense, *Quadrennial Defense Review* (Washington, DC: Government Printing Office, 2014), ix-x.

Support Battalions (ESB), and Marine Wing Support Squadrons (MWSS) are manned to conduct countermobility operations such as planning and installing obstacles and barriers.[101] CEBs are the focus of this study because although each of the above units is capable, CEBs provide countermobility to the ground combat element (GCE) of the MAGTF, ESBs provide general engineering support to the MAGTF, and MWSSs provide limited combat engineering to the aviation combat element (ACE).[102]

A CEB consists of a Headquarters and Service Company (H&S), three to four Engineer Companies, and an Engineer Support Company.[103] Three of the combat engineer companies are identical in force structure and the fourth company is a mobile assault company (MAC). The mobile assault company is focused mainly on mobility.[104] Since the CEB is a division asset, the three engineer companies each support a regiment and the fourth company is kept as the division reserve. The three platoons in each engineer company have habitual relationships and each platoon is organized to support a specific Battalion.

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[101]Department of Defense, *Joint Engineer Operations Course Student Handbook* (Washington, DC: Government Printing Office, 2011), 6 and 166.

[102]Department of Defense, JP 3-34, *Joint Engineer Operations* (Washington, DC: Government Printing Office, June 2011), 30.

[103]Department of Defense, MCWP 3-17, *Engineering Operations* (Washington, DC: Government Printing Office, February 2000), 1-4.

[104]Equipped with the JAB and ABV, the MAC focuses on IED defeat and route clearance.

With the reduction in Marine forces, one of the engineer companies will be removed from the force structure.[105] The loss of one Engineer Company has two possible outcomes: the Marine elements lose their habitual relationships or the MEU loses its reserve engineer company. The most likely course of action is the loss of the engineer habitual relationships. The elimination of the third identical engineer company is the most likely course of action because the mobile assault company (MAC) has capabilities that the three identical engineer companies do not have. However, by losing one combat engineer company, the CEB can no longer provide the support of one platoon for each Battalion. This decrease in manning affects the overall number of countermobility obstacles a MEU can emplace. After the decrease in personnel, the MEU can only emplace six countermobility obstacles with its personnel versus the nine when it had three identical engineer companies. Aside from the number of obstacles a MEU can emplace with its CEB, there is little effect on the MOPM and VOLCANO system.

An Army company consists of roughly 80-110 personnel. A Marine company consists of roughly 110-130 personnel. The numbers provided are general based on various factors such as officer and NCO management, newly formed companies, and needs of the Army. For discussion sake, the assumption will be made that each company has personnel strength around 90 percent. The larger span of personnel listed for an Army company is due to their two distinct company structures. The engineer company with two combat engineer platoons is larger than the company with a combat engineer platoon and a clearance platoon. The reason the combat engineer company is larger is because of the

[105]Information was confirmed during discussion with a Marine Engineer School Training Specialist on 24 April 2014.

platoon’s mission. Another reason is that there are three engineer squads in a combat engineer platoon compared to the two squads in a clearance platoon. Every Marine platoon has three squads. Even when factoring the force structure changes, the Army combat engineer company/platoon is roughly the same size as it has been for the last ten years.[106]

An Army platoon emplacing a FASCAM system will need to be structured into four elements: site and record, marking, emplacing, and munitions management. Site and record takes a section usually comprised of an officer or senior NCO with a driver and security, marking takes a squad, emplacing takes squad, and munitions management takes a squad. Based on the type of FASCAM system used, the importance of a fully manned section increases. Two of the main types of emplacement are hand emplaced or remote delivered. Hand emplaced landmines require “manual arming and are labor, resource, and transport intensive” whereas remote delivered mines require “less time and labor.”[107] The reason that there are so many people dedicated to emplacing and transporting landmines is they weigh a lot. The M15 AT mine weighed 13.5 kg (29.8 lbs), the M19 AT mine weighed 12.6kg (27.8lbs), and the M21 AT mine weighted 7.6kg (16.8lbs).[108] Regardless of the type of emplacement method used, marking is still required. Types of hand emplaced mines include the claymore, MOPM, and Spider system. Types of remote delivered mines include the ADAM, RAAM, GEMSS, and Volcano system.

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[106]Information was confirmed through FMSWeb and USMES and then generalized to present a broad understanding of the unit composition.

[107]Department of Defense, FM 20-32, 1-1.

[108]Ibid., 5-1 to 5-6.

Factors that could affect the capability of engineer manning with respect to elements emplacing FASCAM systems tie back into the training section. With restructuring and downsizing, there may not be any NCOs that have the requisite training, there may be shortages in qualified equipment operators, and there may not be enough personnel to field each squad. At 90 percent strength, it is possible the site and record section will have to assume risk and take personnel from one of the other squads. Each Army platoon could emplace a mine system, but not efficiently. Leadership will have to work hard to ensure that personnel are cross-trained in order to ensure that downsizing and restructuring will not affect the platoon's capability.

At 90 percent strength, both the ABCT and the MEU are effectively manned to support countermobility operations. There are potential risks involved due to restricting and downsizing, such as not enough personnel to emplace or properly mark the minefield. The risks will most likely be seen in the time it takes to conduct the different efforts of a FASCAM system Therefore, both the ABCT and MEU are properly manned to support countermobility operations as long as risk mitigation and proper cross-training is conducted.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

The Department of Defense (DoD) is undergoing changes and during these changes the affects on land forces (US Army and US Marines) capabilities must be considered. This thesis examined, in the midst of DoD restructuring and resource constraints, if the US Army Armor Brigade Combat Team (ABCT) and the US Marine Expeditionary Unit (MEU) are properly trained, equipped, and manned to support countermobility operations without conventional mines on a variety of Asia-Pacific battlefields.

Conclusions

The ABCT and MEU are not properly trained and equipped, but are properly manned to support countermobility operations without conventional mines on a variety of Asia-Pacific battlefields. The cumulative formal training for both services does not cover all of the six FASCAM focus areas. Although MOPMS is a hand emplaced system that can create obstacles for armor vehicles, there is a shortage within units. Additionaly, the MEU does not currently have a hand emplaced mine systems other than the claymore. At 90 percent strength, the ABCT and MEU can man the four elements necessary for a FASCAM system.

Training was analyzed by looking at doctrine and curriculum of company grade Officer Education System (OES) and Noncommissioned Officer Education System (NCOES). Formal training was analyzed by evaluating against the Family of Scatterable Mines (FASCAM) focus areas for effectiveness: employment theory or concepts, system

components, how to preventive maintenance checks and services (PMCS) the system, initiation procedures, retrieval procedures, and troubleshooting procedures. Research revealed a systemic problem with training: course curriculum covered, at most, four of the six FASCAM focus areas. Advanced Individual Training (AIT), Advanced Leaders Course (ALC), and Senior Leaders Course (SLC) from the Army engineer enlisted formal training was studied. Combat Engineer Noncommissioned Officer Course (CENCO) and Combat Engineer Platoon Sergeant Course (CEPS) from the Marine engineer enlisted formal training was also studied. Research revealed the most thorough enlisted formal training was AIT. Surprisingly, ALC and SLC taught the exact same course of instruction. AIT, although the most thorough of the five formal enlisted education schools, only conducts training on four of the six FASCAM focus areas.

Research of Engineer Basic Officers Leader Course (EBOLC) and Engineer Captain Career Course (ECCC) from the Army engineer officer formal training and Combat Engineer Officers Course (CEO) and Expeditionary Warfare School (EWS) from the Marine engineer officer formal training revealed the most thorough officer formal training was ECCC. ECCC, similar to AIT in training, only conducts training on four of the six FASCAM focus areas. Both the CEO and EWS taught only two of the six FASCAM focus areas. The analysis supports the determination that formal schooling is inadequate for both the Army and Marines with respect to FASCAM training for the Modular Pack Mine (MOPM), Volcano, and Spider systems. Both the Army and Marine Corps rely heavily on professional development through additional training, on the job training (OJT), and independent study. Unfortunately, only one additional training school of the four researched (Army Sapper Leader Course, Marine Sapper Course, Area

Clearance Course, and Joint Engineer Officer Course) significantly improved FASCAM knowledge and the other three engineering schools failed to improve formal school training.

Current equipment analysis was accomplished through historical studies of conflicts in the Philippines, Korea, and Vietnam. These Asia-Pacific conflicts demonstrated how countermobility operations can be applied with today's FASCAM capabilities. Illustrations of capabilities were executed through comparisons of traditional landmines to today's FASCAM systems and other countermobility capabilities. There were historical examples from the Asia-Pacific region in which countermobility operations were successful without conventional landmines.

During World War II, the battles on the island of Luzon demonstrated several examples of countermobility. Manmade and natural obstacles were utilized to create a blocking position at the Balete pass in the Cagayan Valley. Although effective, these obstacles could have been more successful with anti-tank obstacles such as the Volcano and MOPM systems. The battle at the main line of defense required multiple types of obstacles with ingenuity and adaptability because of the dense vegetation. Creating multiple effects throughout the island would be risky for today's ABCT and very hard for today's MEU. Today's systems would be inefficient without multiple FASCAM loads for the Volcano and MOPM system.

Task Force Smith's battle in Osan during the Korean War illustrated how integrated defensive positions augmented by mortars and crew served weapons are ineffective against armored vehicles. Artillery fired munitions and the MOPMS would be very effective against the armored vehicles. The use of wire and other manmade obstacles

and the Spider system would also have been effective for not just vehicles, but enemy infantry as well.

The battles in the iron triangle of Vietnam showed challenges with conventional landmines. Today's FASCAM systems of both the ABCT and MEU would have improved the effects of the multinational forces countermobility due to better tactics, techniques, procedures (TTPs) and anti-handling/trip wires. All three conflicts showed that each FASCAM system could not be used effectively for every scenario; however, land forces do have the necessary equipment to achieve the same initial if not better countermobility effects that were intended in each conflict analyzed.

There were two main differences identified between FASCAM and conventional mines: affected area and unit emplacement. FASCAM systems can affect a greater area due to improvements in trip wires, anti-handling devices, and detection systems. Although conventional mines have anti-handling devices they are not as effective as the ones used with FASCAM. The improvements to FASCAM, such as the ones mentioned above can create an obstacle effect with significantly less mines from a FASCAM system than it would take conventional mines. The second difference between FASCAM and conventional mines is the higher approval authority required for emplacement of FASCAM. MOPMS and the Spider system emplacement authority is at the Company level; all other FASCAM systems require a higher approval authority. Additionally, although emplacement can be delegated for first time use of FASCAM, most munition resupply is kept at a higher approval authority. It is assumed that through technology, individual mines from the FASCAM system weigh less than a conventional mine. Unfortunately, doctrine currently does not specify FASCAM mine weight.

The DoD has appropriated roughly $45 million on new technology to develop systems to fill or supplement the capability gap of conventional mines. There are two known systems in development. The XM1100 Scorpion system developed new technology that was incorporated into the Spider increment II program. The Selectable lightweight attack munition (SLAM) is being developed by the Project Manager Close Combat Systems (PM CCS).

Current manning analysis was accomplished by determining if a less than fully manned unit could create the four necessary elements of a FASCAM system: site and recording, marking, emplacing, and managing the munitions. Although the technical knowledge is vast for the Army military occupation specialty (MOS) 12 and the Marine Corps MOS 1300 within a company, it was illustrated how only the three platoons from the Brigade Engineer Battalion (BEB) and three companies from the Combat Engineer Battalion (CEB) should be conducting countermobility operations. It was assumed that personnel losses will be distributed throughout the BEB and a decrease of one entire company in the CEB. Potential issues were identified in three of the four elements: the site and recording, marking, and emplacing. If an officer or senior NCO departs a unit without a backfill, it limits the amount of personnel trained to conduct site and recording. This void could cause issues as senior NCOs are pulled from the other elements. If there are not enough personnel to mark a minefield, it increases the time engineers are required to stay in the engagement area. It is preferred for marking and emplacing to occur simultaneously. However, based on the system, marking may have to occur after emplacement. Another potential issue could arise in the emplacing element because there are still hand emplaced FASCAM systems such as the claymore, MOPM and Spider

systems. This effort is a resource intense operation, due to the time it takes to emplace and activate each mine. For the above reasons, the ABCT and MEU need to be manned to 90 percent strength in order to properly execute countermobility operations. Although challenged at 90 percent, both the US Army and the US Marine Corps are able to conduct countermobility operations without conventional mines on a variety of battlefields.

The research done on countermobility is significant because it has shown there is significant room for improvement to the way land forces are trained, equipped, and manned for countermobility operations. Currently, formal school training does not prepare officer or enlisted engineers in either the Army or Marines to conduct FASCAM operations. Two innovations are currently being explored in FASCAM system and money has been appropriated for countermobility development through FY 2015. However, with units only being issued equipment when it is deployed, their experience level and learning curve to use the equipment significantly increase. Finally, it has been shown that units are sized by capability. If engineer manning drops below 90 percent, the risks of accomplishing missions significantly increases.

Relationships to Previous Studies

The arms control website only mentions which countries are formally adhering to the Ottawa treaty. There is no mention which countries are blatantly violating the treaty and which countries are supporting the treaty even though they have not ratified it. The website also has not highlighted the initiatives that NATO is currently implementing. One initiative that was unable to be further researched is the dud rate of Dual Purpose Improved Conventional Munitions (DPICM). Most of the Center for Military History (CMH) publications were written at the operational and strategic level. Logically, this is

most likely the case because company commanders usually don't write memoirs. Additionally, mobility and general engineer operations were written in much greater detail. With doctrine being revised, information captured in old field manuals has not caught up to the revised work. Some information has been distributed and requires consolidation of information from three to four sources in order to equate to the one old source. There are old documents that have general information such as the Marine Corps Military Occupation Specialty handbook and the Sapper handbook. Unfortunately, they have not been revised recently and communication with the United States Army Engineer School (USAES) and United States Marine Engineer School (USMES) was used to verify data. Conversely, messages delivered in forums such as regimental conferences address potential changes that have not been captured in the written form. The Defense News and Textron defense systems both discuss the XM1100 as if it is still being developed; yet, the defense technical information center articulates how the system was being incorporated into another program. The SLAM system was only seen on the PM CCS webpage; no other sources or doctrine has captured its development.

Recommendations

Further training research should be conducted on additional training courses and OJT. Additional training areas of focus are the Sapper Leader Course and Picatinny train-the-trainer course. The Sapper Leader Course will need confirmation if eligibility has indeed changed[109] and to what extent countermobility will be removed from the training in the coming years. The Picatinny train-the-trainer course can be further analyzed in two

[109]Briefly mentioned at the Engineer Regimental Conference 2014 (previously ENFORCE); nothing official has been documented as of 1 May 2014.

areas. The first area is a qualitative or quantitative analysis at the Brigade level; this should be done to determine exactly how many units have FASCAM leaders that are train-the-trainer certified and what their plan is for teaching and certifying leaders. The second area is to determine consistency: what percentage of units received new equipment training? How long was it? What was taught? Is it cost effective to bring the trainers back for advanced training on equipment?

Further analysis of equipment in development, in preparation for fielding, and potentially removed from inventory will determine what capabilities units will be equipped with for future missions. Two systems that were unable to be researched in detail during this paper are the Spider Increment II program and the SLAM. Research needs to be done to determine when the equipment will be fielded, to what units, how many of each system each unit will get, and when the fielding will be complete.[110] Although there is data available on the current Spider mine system, the system was just fielded and the lessons learned in a few years could impact how the system is employed. One munition that may be removed from the DoD inventory is the DPICM. The DoD is having challenges with dud rates in the DPICM. The cluster munition policy from 2008 states that by 2018, no munitions will be used that have a dud rate of over one percent.[111] Although the DoD is working to correct this issue, what affect will loss of DPICM have on countermobility?

[110]Due to time constraints, unable to continue contacting Product Manager for Area Denial Office at Picatinny Arsenal.

[111]Department of Defense, "Cluster Munitions Policy Release," http://www.defense.gov/releases/release.aspx?releaseid=12049 (accessed 16 May 2014).

Further study could be done at a higher classification level to show exact numbers and exactly how many personnel are needed in each element to complete the directed countermobility effect. This will play a big part if force structure continues to get smaller in both the Army and Marine Corps. Research could be done to determine what changes to Modified Table of Organization (MTOE) are planned in 2017 if sequestration occurs again.Countermobility operations are a key part of the DoD capabilities and adequate research, time, and resources need to be dedicated for further improvement .

GLOSSARY

Anti-tank – changed to anti-vehicular landmine.

Anti-vehicular – A mine designed to immobilize or destroy a vehicle.[112]

Company Grade – Officers that are at the rank of Second Lieutenant (O-1) to Captain (O-3).

Combat Engineering – "defined in joint doctrine as consisting "of those engineer capabilities and activities that support the maneuver of land combat forces and requires close support to those forces."[113]

Countermobility Operations – "Those combined arms activities that use or enhance the effects of natural and man-made obstacles to deny an adversary freedom of movement and maneuver."[114]

Courthouse Bay – home of the Marine Corps Engineer School.

Obstacle – "as an object that you have to go around or over: something that blocks your path."[115]

Protective Obstacle – "used to protect personnel and assets from hostile actions by impeding the movement and maneuver of enemy forces or criminal elements."[116]

SD – Self destruct; the time that a munition is active prior to its designated destruction setting.

Situational Obstacle – "an obstacle that a unit plans and possibly prepares prior to starting an operation, but does not execute unless specific criteria are met."[117]

Variety of Environments – for the purpose of this thesis will be defined as different countries within the Asia- Pacific region (Philippines, Korea, and Vietnam).

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[112]Department of Defense, JP 1-02, 22.

[113]Department of Defense, JP 3-34, 12.

[114]Department of Defense, ADRP 1-02, 1-15.

[115]Encyclopaedia Britannica, "Obstacle," http://www.merriam-webster.com/ (accessed 30 April 2014).

[116]Department of Defense, ATP 3-90.8, 1-7.

[117]Ibid., 1-6.

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